

THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA
FOR THE PROMOTION OF THE MECHANIC ARTS

Hall of the Institute,

Philadelphia, February 8, 1953.

Report No. 2942.

Investigating The Multi-Motored Amphibion

invented by

Mr. Igor I. Sikorsky, of Bridgeport, Connecticut.

Application dated March 13, 1931.

THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA

For the Promotion of the Mechanic Arts

Committee on Science and
the Arts Case No. 2942.

Hall of the Institute,

Philadelphia, February 8, 1933.

The Franklin Institute of the State of Pennsylvania, acting through its Committee on Science and the Arts, investigating the Multi-Motored Amphibian invented by Mr. Igor I. Sikorsky, of Bridgeport, Connecticut, reports as follows:

Our attention was first called to Mr. Sikorsky's United States Patent granted for a device for the direction control of airplanes, but as our study of this invention and his development of several types of airplanes through many years, progressed, it was decided that in addition to an investigation of this device, his work in airplane design and construction should be included in this report.

Mr. Igor I. Sikorsky was born in Kieff, Russia, in 1889, and obtained his education in the Mechanical College of the Kieff Polytechnical Institute. He became interested in aviation at an early age and after a number of years of studying, designing and construction of the more simple forms of airplanes, made the first successful multi-motored airplane in 1913. This plane was driven by four 100 h.p. motors and was followed by another four-

1 motored plane capable of lifting, in addition to its own weight, 10,340 pounds.
2 More than fifty successful flights were made with this plane.

3 His four-motored planes made in 1914 established a number of
4 world's records including a 1000 mile flight from Petrograd to Kieff and re-
5 turn without accident or forced landings. This was the first long cross
6 country flight made by a multi-motored plane.

7 In this same year Mr. Sikorsky built a series of large multi-
8 motored airplanes, the largest having a total weight of 17,600 pounds when
9 carrying a useful load of 6600 pounds. This plane was equipped with four
10 220 h.p. Renault motors.

11 During the World War of 1914-17, seventy-three Sikorsky air-
12 planes were built and delivered to the Russian Army by the Russo-Baltic Works
13 in Petrograd. These planes made more than 400 flights, made the first heavy
14 air bombardments and but one of them was brought down in action. The safe
15 return of many of these planes after one or two of their motors had been put
16 out of commission proved the superiority of the multi-motored plane.

17 In 1919 Mr. Sikorsky came to the United States and became an
18 American citizen. The same year he began to study the aviation requirements
19 of this country.

20 In 1923 the Sikorsky Aero Engineering Corporation was formed
21 and the twin-engined S-29 which had a cabin capacity of fourteen passengers
22 was built. This corporation was absorbed in 1925 by the Sikorsky Manufac-
23 turing Corporation of which Mr. Sikorsky is President.

24 Many different types of planes were developed and manufactured
25 by this Corporation, one of the most notable being the S-36, an eight seater

1 amphibion equipped with two Wright J-5 engines. This was the first multi-
2 motored amphibion to be flown successfully.

3 During the same year there was developed by this Corporation
4 the S-38, a new model amphibion equipped with two Pratt & Whitney Wasp engines
5 of 410 H.p. and having a seating capacity of from ten to twelve persons.

6 The success that has been secured by the later type of airplane
7 developed by Mr. Sikorsky appears to establish the advantage of the Multi-
8 motored principle that may be stated as the ability of a fully loaded multi-
9 motored airplane to continue to fly using less than its full number of power
10 plants.

11 The successful application of this principle enables a pilot
12 to take off for an extended flight with reasonable assurance that he will be
13 able to reach his destination without either loss of his freight or injury
14 to his passengers.

15 Mr. Sikorsky made application for a United States Patent on
16 his Multi-Motored Flying Machine on March 9, 1923 and Patent No. 1,560,869
17 was issued on November 10, 1923.

18 The purpose of the invention, as stated in the patent, is to
19 automatically correct the tendency of a multi-motored airplane to veer from
20 its course when one of its motors fails to operate. The method of securing
21 this result is shown in Plate I, made from a drawing in the patent. The
22 Plate shows a three motored plane, motor 8 being placed at the forward end
23 of the fuselage and motors 9 and 10 being symmetrically located, one on each
24 side of the center line as shown in Figure 1. Two rudders 15 and 16 are
25 mounted, each on a vertical axis on the tail of the plane and can be used to

control the direction of flight by the pilot by means of the foot pedals 21 and 22, when all the motors are operating normally. If, however, one of the motors - 9, for example - fails, the tendency is for motor 10 to veer the plane to the left as soon as motor 9 fails. Since the tail rudders 15 and 16 are located in the air stream sent back by the motors the effect of these streams is zero when both motors are running normally but is to keep the plane on its course if one motor fails and the effect of the air stream is unbalanced. Not only is that action automatic but it goes into effect immediately as soon as the motor fails.

The different figures shown in Plate I indicate different forms of rudders that may be used dependent upon the conditions, form of the plane and results to be obtained. Figure 6 shows one form in which a part 31, of the rudder is fixed in position while part 30 is movable.

Plate II shows the Multi-motored amphibion embodying the automatic control. This plane is of especial value for use where the landing is to be made on water instead of on landing fields that are frequently at some distance from the business center of the city.

There has been an increasing demand for this type of plane which is used by airway companies, business firms and individuals.

Up to the present time nearly 100 multi-motored airplanes and amphibions have been constructed from Mr. Sikorsky's design and under his supervision since his arrival in America. These include the two forty-four (44) passenger multi-motored "American Clipper" and "Caribbean Clipper", said to be the largest heavier-than-air aircraft now in regular operation in any airline in the world. These are four-motored amphibions, shown in Plate III,

1 and are used in South American service in both the Pan American Airways and
 2 the Pan American-Grace Airways. These two companies cover the following
 3 routes:

4	Miami	to	Barranquilla, South America
	"	"	San Juan, Porto Rico
5	Panama Canal	"	Talara in Northern Peru

6 And on several other sections of the airways.

7 Following is a list of owners of Sikorsky Multi-motored planes:

8	Pan American Airways, Inc., New York
9	Pan American-Grace Airways, Inc., South America
10	Varney Air Service, Ltd., California
11	Inter-Island Airways, Ltd., Honolulu
12	Northwest Airways, Inc., Wisconsin
13	Canadian Airways, Ltd., Canada
14	Miller Airways, Inc., Canada
15	Alpine Airways, Inc., Massachusetts
16	Scadta Airways, Colombia
17	Personal Flying Service, Ltd., England

14 The following information was obtained regarding the prior art
 15 of multi-motored planes. In 1894 Sir Hiram Maxim, in England, built a steam
 16 powered large airplane whose pusher propellers were driven by two engines
 17 totalling 320 h.p. This machine never was in the air in controlled free flight.

18 Clement Ader, in France, in 1897, built a monoplane named the
 19 "Avian". It was steam powered and had two tractor propellers, each driven by
 20 an engine. Observers of a test run stated that the machine left the ground
 21 for a short hop.

22 The Short Brothers of Eastchurch, England, built two aeroplanes,
 23 one a monoplane with tandem engine - one a pusher and one a tractor - and the
 24 other a biplane. This biplane was (it is believed) in the first place, built
 25 with one engine driving a tractor airscrew and one engine driving a pusher

1 airscrew with the pilot sitting between. Later this aeroplane was altered so
2 that one engine still drove a pusher airscrew but the other engine drove two
3 tractor airscrews through a chain drive. These experiments were carried on
4 about the end of 1912 and during 1913.

5 Technical Memorandum No. 478 of the National Advisory Committee
6 for Aeronautics, refers to the early work of multi-motored planes as follows:

7 "The beginnings of the superairplane extend back
8 into the prewar period. If the historical airplane
9 of the Englishman, Hiram Maxim, be disregarded, the
10 honor doubtless belongs to the Russian engineer
11 Sikorsky for having designed and built the first
12 serviceable superairplane. The first Sikorsky four-
13 engined airplane was begun in 1912 and was finished
14 and flown in 1913."

15 Colonel Charles A. Lindbergh was the pilot for the Sikorsky Am-
16 phibion S-38 which he used in opening the Pan American Air Mail Service on Febru-
17 ary 4, 1929. This service started from Miami and ended at Cristobal at the
18 Caribbean end of the Panama Canal, on February 6th, bringing these two cities
19 twelve days closer together.

20 This path finding flight opened the route to Latin America shown
21 in Plate IV which has resulted in establishing mail and passenger communication
22 over an extended airway that is proving of much service. The course is not
23 only an extended one but is over much uninhabited country both forest and
24 mountains, that required the freedom from failure that the Multi-motored am-
25 phibion provides.

26 The Pan American Airways System includes both the East and the
27 West coasts of South America. The extent of business carried on is shown by
28 the statement that in 1930 more than 50,000 passengers were carried, as well

1 as 370,000 pounds of mail and express. The distance flown was more than
 2 2,500,000 miles and though the route was more difficult than any in the United
 3 States there was not a passenger injured.

4 Through correspondence many favorable opinions were received
 5 from users of the Sikorsky planes.

6 In consideration of his pioneer work and inventions in the de-
 7 velopment of multi-motored airplanes of various types, for different uses, in-
 8 cluding amphibians and the largest combined planes for land and water service,
 9 and of his method of direction control of multi-motored machines by the use of
 10 an automatic stabilizer, THE FRANKLIN INSTITUTE awards its HOWARD N. POTTS
 11 MEDAL to MR. IGOR I. SIKORSKY, of Bridgeport, Connecticut.



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Walter Hayward
 President.

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Howard Ullman
 Secretary.

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Reedvald T. Clark
 Chairman of the Committee on Science
 and the Arts.

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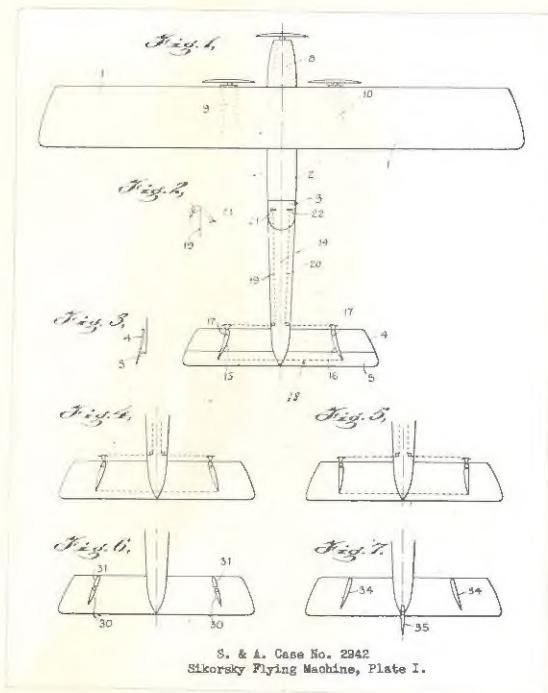
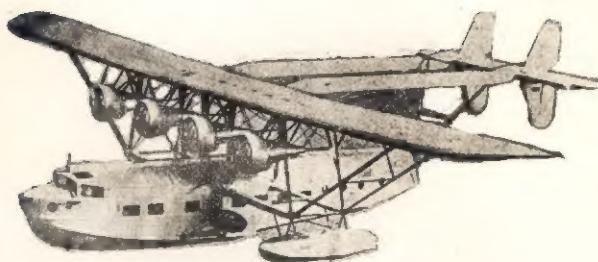


PLATE I.



S. & A. Case No. 2942
Sikorsky Flying Machine, Plate II.

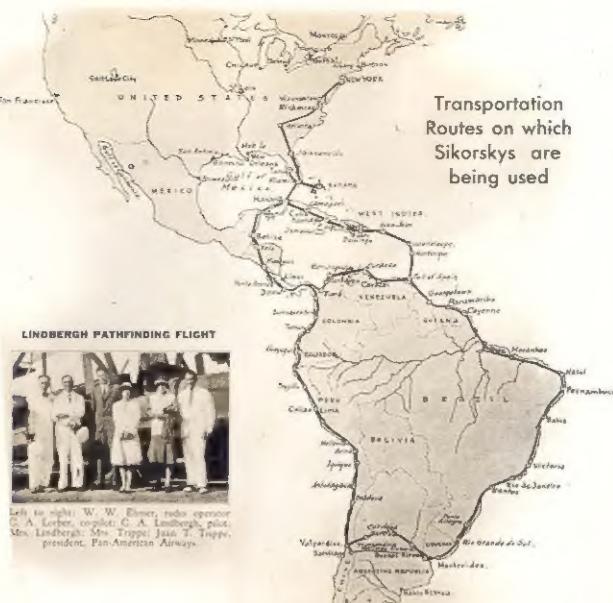
PLATE II.



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The Caribbean Clipper, largest Amphibian plane with accommodations for 45 passengers, which will fly Dino Grandi, Italian Foreign Minister, and his party to Washington from New York today. It will be piloted by Colonel Charles A. Lindbergh.

S. & A. Case No. 2942
Sikorsky Flying Machine, Plate III.

PLATE III.



Left to right: W. W. Elmer, radio operator; G. L. Johnson, C. G. G. C. pilot; Mrs. Lindbergh; Mrs. Tripp; Juan T. Trippe, president, Pan-American Airways.

S. & A. Case No. 2942
Sikorsky Flying Machine, Plate IV.

PLATE IV.